

pressed puberulous; corolla tube 16–17 mm long, the lobes 12 mm long, 0.3 mm wide; anthers 8 mm long; and the pappus bristles 38.

The new epithet is formed from the name of

the type locality, Maui, and *-ensis*, the Latin adjectival place ending.

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TORTULA CHISOSA SP. NOV., A BISTRATOSE-LEAVED SPECIES FROM THE UNITED STATES, MEXICO, AND SOUTHERN AFRICA

Tortula chisosa Magill, Delgadillo et Stark, sp. nov. is described here from material collected in North America and southern Africa. It is closely related to *T. ammonsiana* and *T. bartramii*.

In 1976, one of us reported the occurrence of an unusual specimen of *Tortula* from the mountains of west Texas (Magill, 1976). The specimen (Magill 1341) was of interest because of a unique combination of characters that separated it from all North American species of *Tortula*. In connection with a study of mosses of Zacatecas, Mexico (Delgadillo & Cárdenas, 1979), four specimens that are nearly identical with the Texas plants were obtained; L. Stark and R. C. Castetter collected five others in New Mexico, and R. Magill secured two additional collections in southern Africa. Comparison of these specimens against specimens and descriptions of other taxa suggests that the first represent an undescribed species of *Tortula*.

Tortula chisosa Magill, Delgadillo et Stark, sp. nov.

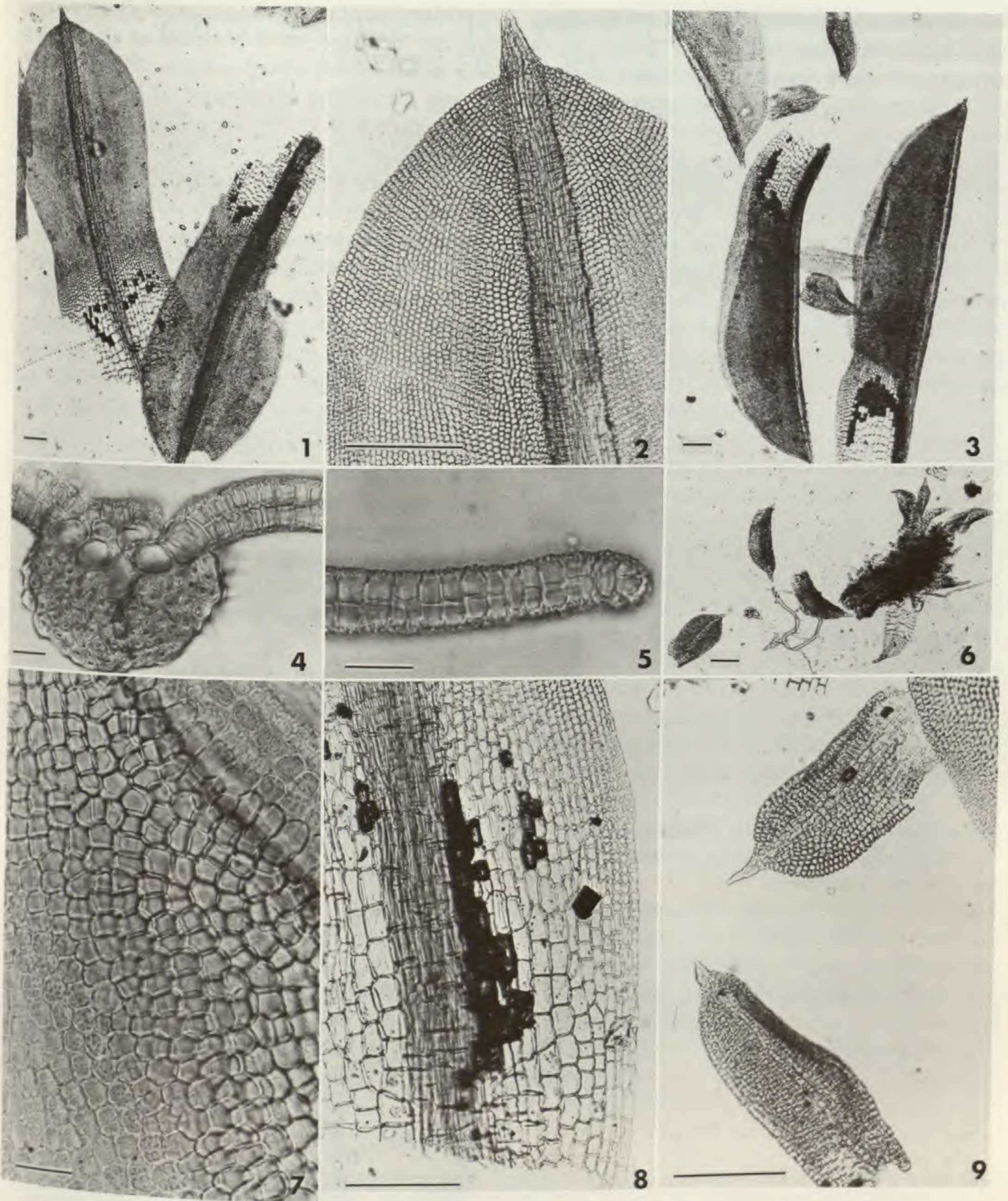
Habitu et forma foliorum et propagulorum *T. ammonsiana* Crum et Anderson simile, sed foliis bistratosis et apicibus sine denticulatis et costa dorsali supra papillosa differt.

Plants with the habit of *T. ammonsiana*. Stem up to 6 mm tall, loosely tufted, dark brown to nearly black when dry, with a small central strand and an inconspicuous hyalodermis. Leaves loosely appressed when dry, erect spreading when moist, 0.5–0.7(–0.8) mm wide, 1.2–2.3 mm long, smaller toward the base of the stem, crowded near the tip, oblong to spatulate. Leaf blade bistratose, entire; margins plane; upper and median leaf cells quadrate or hexagonal, firm-walled, 8–

13 μm in diameter, with several hollow c-shaped papillae per lumen; basal leaf cells hyaline, quadrate to rectangular, smaller toward margin, forming distinct fenestrations on lower third or fourth of the leaf. Costa reddish, excurrent as a short mucro, dorsally papillose on the upper third to halfway down, 58–103(–113) μm wide at mid-leaf, in section with a strong dorsal stereid band of 4–7 layers of cells, 2–4 guide cells and 2–4 adaxial papillose cells; the hydroid group is inconspicuous. Propagulae in groups on stalks in axils of upper leaves, stalked, costate, leaflike, with upper cells papillose, ending in a single hyaline smooth-walled apical cell, that may be subtended by 2 or 3 smooth-walled cells. Perichaetial leaves not differentiated. Male inflorescence and sporophyte unknown.

TYPE: U.S.A. TEXAS: Big Bend National Park, Chisos Mountains, on soil in small canyon below Lost Mine Trail, W side Lost Mine Peak, ca. 1,600 m, 19 June 1973, Magill 1341 (MO, holotype).

Additional specimens examined: U.S.A. NEW MEXICO: Doña Ana Co., ca. .25 mi E of Dripping Springs area, W side Organ Mountains, 32°19'N, 106°34'W, 2,072 m, 10 July 1980, Stark & Castetter 1154 (MEXU, PAC); Filmore Canyon, Organ Mountains, 32°21'N, 106°35'W, 1,813 m, July 1981, Stark & Castetter 3102A, 3105A, 3106A, 3107A (PAC). MEXICO. ZACATECAS: Cerro de la Bufa, 22°47'N, 102°34'W, 2,700 m, Junio 1979, Cárdenas 332b (MEXU); 2 km E Gualterio, Mpio. Chalchihuites, 23°35'N, 103°49'W, 2,250 m, Marzo 1981, Cárdenas 1077c (MEXU); La Boquilla, 7 km S Sombrerete, 23°34'N, 103°38'W, 2,380 m, Marzo 1981, Cárdenas 1113 (MEXU); 8 km N Pinos, 22°22'N, 101°35'W, 2,590 m, Marzo 1981, Cárdenas 1195 (MEXU). LESOTHO: 233 km E of Maseru, S of St. Theresa, canyon along Orange River, Dec. 1977, Magill 4242 (MEXU, PRE). SOUTH WEST AFRICA: Buchenberg summit, S Namib, Sept. 1977, Williamson 2675d (MEXU, PRE).



FIGURES 1-9. *Tortula chisosa*.—1. Leaves.—2. Leaf apex.—3. Leaves and propagulae.—4. Median cross-section of costa showing dorsal papillae.—5. Median cross-section of leaf margin.—6. Propagulae and stalk.—7. Upper laminal cells, costa at upper right corner.—8. Basal leaf cells and right basal leaf margin.—9. Propagulae showing costal development. (All Magill 1341). Bars equal 0.1 mm in Figures 1, 2, 3, 6, 8, 9 and 20 μ m in Figures 4, 5, and 7.

This new species is distinguished from other species of *Tortula* by the plane, mucronate-spatulate leaves with reddish, papillose costae, bistratose laminae; the production of stalked, clus-

tered, costate, leaf-like propagulae; and a terricolous or saxicolous habitat. This combination of character states is remarkably constant but not exempt from variation in the collections

thus far analyzed. For example, the leaf laminae, while consistently bistratose in all specimens, in several cases show unistratose patches in mid-leaf cross sections. Stalked propagulae have not been observed in three specimens: *Cárdenas 1077c*, *Magill 4242*, and *Williamson 2675d*, even though other diagnostic features are present. The last specimen has additional variations that are of interest in the evaluation of the species; its leaf cells are consistently smaller (7–10 μm) than those of the American collections and the angle of leaf blade insertion is steeper. Also, the leaves are keeled, a fact that is not evident on other specimens.

Tortula chisosa is similar in many respects to *T. caninervis* (Mitt.) Broth. (syn. *T. bistratosa* Flowers); however, in the latter species the plants are larger, the leaf margins are recurved, and the leaves awned. Through the production of leaf-like propagulae, *T. chisosa* is also related to the *T. pagorum-laevipila* complex. The similarities in habit and habitat, leaf form and method of propagule production clearly indicate relationship to *T. ammonsiana*. This last species was described from the eastern United States (Crum & Anderson, 1979) and would appear to be one of the closest relatives of *T. chisosa*. However, the differences between them are clear; the leaves of *T. chisosa* are bistratose, they lack minute apical teeth (also absent in African specimens of *T. ammonsiana*), and the costa is papillose dorsally toward the apex.

In New Mexico *Tortula chisosa* has been found intermixed with plants of *T. bartramii* Steere; study of both plants from the same sites has shown that they are similar in cell size, stem, and costal structure. Leaves of *T. bartramii* had occasional bistratose patches and, in one instance, one plant showed a few small apical leaves that resembled the propagulae of *T. chisosa*. Despite this, the

combination of character states by which we define our new species is maintained and allows easy separation of mixed samples. The nature of factors promoting appearance of leaf-like propagulae and bistratosity are beyond the scope of this paper, but, undoubtedly, they should be explored before a final evaluation of the relationships of *T. chisosa* and *T. bartramii*.

The present known distribution of *T. chisosa* may at first appear unusual. However, it apparently parallels that of several better-known species, e.g., *Aloina bifrons*, *Anacolia laeviphaera*, *Tortula pagorum*, and *Trichostomopsis australasiae*. Thus, we would expect to find *T. chisosa* in South America or Australia to complement its occurrence in Africa.

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LITERATURE CITED

- CRUM, H. & L. E. ANDERSON. 1979. *Tortula ammonsiana*, a new species from West Virginia. *Bryologist* 82: 469–472.
- DELGADILLO M., C. & M. A. CÁRDENAS S. 1979. Musgos de Zacatecas, México. I. *Boletín de la Sociedad Botánica de México* 38: 1–6.
- MAGILL, R. E. 1976. Mosses of Big Bend National Park, Texas. *Bryologist* 79: 269–295.
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